A CONSTRUCTION PRODUCT BROWSER

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ABSTRACT

The World Wide Web contains a wealth of information from manufacturers of building products which needs to be gathered and reorganized in order to be used by designers. Currently there is a tendency to develop systems based on database architecture that require large amounts of structured data newly compiled from the sources, and it takes great effort to update the data in the database that changes with time. This process can be supported only by large and expensive organizations.
In this paper we discuss the requirements and conceptualize an information system that knows where certain pertinent information is and helps the users to find it by means of a retrieval system based on natural and controlled querying language. Our system also helps the user decide between alternatives and lets him select only some information out of all the data that usually comes in a product's data sheet. The program further allows the user to download the data and use it in his project.
In order to allow the producers of building products to give information according to their own layouts without being forced into a rigid standardized layout, we propose an indexing system based on the application of blind labels (tags) to the existing source code (html) which describes the information about a product that is already on the Internet. The tags are based on the Master Lists and EPIC's construction-product grouping. Each piece of information indexed by its own tag will be handled by a specialized software that will put it in the right place in our newly developed product data sheet. This mechanism avoids the construction of a centralized database, and replaces the need for it by accessing a series of indexed documents containing indexed information already on the Internet.

Keywords: World Wide Web, Information system, classification, design, CAD, component libraries.

1.INTRODUCTION

The overall theme of this research is concerned with developing methods to improve the quality of the building design process. Having recognized the central role played by the management of information as a means to improve the design process, we wish to provide the designer with a tool for fast and accurate retrieval of technical information on building products. We also wish to deliver information in a form directly usable by CAD systems and other design tools.

From our point of view, the WWW contains a great deal of information from manufacturers of building products which is usually quite difficult to find using common or general keywords on the search engines. This information could be easily accessed and used by designers if gathered and reorganized. To solve this problem currently there is a tendency to develop systems based on database architecture that require large amounts of structured data newly compiled from the sources, and it takes great effort to update the data in the data base that changes with time (Sanders 1996). This process can be supported only by large and expensive organizations. These two considerations have led us to conceptualize and develop a model and a simulation of an information system that knows where certain pertinent information is, and helps the users to find it. It also helps user decide between alternatives and lets the users select only some information out of all the data that usually comes in a product's data sheet; and it further allows the designer to download the data and use it in his project.
The aim of our project is to provide an information system which organizes data already available on the WWW. This does away with expensive and time-consuming creation of huge

databases that duplicate information. Our project will thus be more cost-effective and more accessible for those involved in building design.

This paper presents:
- expectations for a construction product browser and an analysis of the reasons for such a system;
- a scenario showing the use of the proposed system by a designer;
- a general schema outlining the dynamics of the relationship between designers, manufacturers, and agencies using our system;
- the general system architecture of our Construction-Product-Browser, as a specialized tool for designers to manage building product information from the Web.

2.EXPECTATIONS FOR A CONSTRUCTION PRODUCT BROWSER

The developing market

The recent focus on use of network services for the distribution of information in the field of building construction is creating a market-demand for building construction product information on the net. In the last year the number of manufacturers on WWW has increased rapidly and we can foresee that this trend will continue in the years to come. The distribution of information on WWW has large potential. Currently the WWW allows:
- high-access speed to information held in automated retrieval systems, although often this is limited by the huge quantity of data to be consulted;
- real-time and zero-cost updating;
- easy transfer of retrieved data to the original drafts through 'copy and paste' operations;
- low-cost delivering and publishing of information;

In spite of the above considerations concerning the capabilities which make the network medium the most suitable to convey technical information, we can state that in the building sector this assumption is currently reversed. As a matter of fact, at this moment, the paper medium is the most used and still guarantees the best results when searching for technical information. Firms producing building components have been conveying information for many years. Professionals are used to this and are at ease when consulting paper documents.
The examples of CD-Rom issues for building product information - - often developed by isolated promoters - - aim more at giving prominence to the companies participating in the enterprise, than at providing really usable information to designers. CD-Rom issues for building cover a limited range of national and foreign building products, and are characterized by limited flexibility in their information retrieval systems.
Finally, the Network also included isolated cases of producers who saw marketing potential in it, but lacked specific sector knowledge and could not exploit the medium (Christiansson 1996). Network sites usually display photographs of building intervention carried out with the producer's materials, technical charts that are exactly the same as the paper ones and at best some technical drawings illustrating the way to lay out a component. Current sites mimick paper brochures, and are not a new communication tool rearranged to suit the new medium. Caught in the paper paradigm for passing of information, current sites fail in flexibility and selection options.The case of an italian waterproofing materials firm is emblematic; if you connect to its Internet site, you will see a button appear on the screen, and if you push it, "... you will be personally contacted by one of our agents!" Obviously the computer is extraneous.

Designers´ needs

- Designers should have access to specific product data without having to pass through a manufacturer´s web site. Such web sites usually contain much extra commercial information that is not pertinent to the designer’s aims;
- Designers generally only need some of all the data that usually comes in a product’s data sheet. In fact designers must now sort through different information about building components and materials developed for many target groups.So,all different needs and wishes. Now information is accessed completely each time and ignores the changing needs during the design process;

- Designers should be able to make a selection between different product alternatives. This selection is now very hard to make because similar products from different manufactures are not linked comparatively;
- Designers should be able to download the data and use it in individual project (Vendruscolo 1994);

Manufacturers´ needs

- Manufacturers aim to widely distribute information on their products, so their web sites are filled with information not necessary for designers. They have all kinds of information about their organization, and production on web sites to satisfy the different needs and wishes of all different target users;
- Manufacturers aim to present their products as something different then the competitors. We consider the desire of suppliers to differentiate their products and services from those of their competitors. Indeed, this differentiation is one of the primary mechanisms for attaining competitive advantage (O'Brian,1996). So, we think the manufactures should be free to organize the structure and the content of information published on their sites without being forced into a rigid, standardized layout;

Relationship to related developments

International research is focused on a common effort to develop a standard for product description (STEP) and classification (EPIC). That research aims to have all the information about building construction written in the same language with many opportunities for retrieval and exchange of data between different disciplines.
All such efforts concern the future. Meanwhile, our effort is focused on the present and how to improve existing information on-line. At the present time we can expect the transitional time between the present and the implementation of EPIC and STEP to be quite long, especially for countries like Italy where there is a lack of use of information-classification systems and communication standards for technical information.
The conveying of technical information about building products and components via the Internet has much wider potential than that which is used at present: accessibility, updating, expansibility and utilization of data. The benefit of computer access will be duly appreciated if information could be arranged comparatively and if retrieval systems can permit free access to information.

3.SCENARIO

An architect is using his CAD to design, he needs information about a building product (e.g. material for cladding for an external wall), he is connected via Internet to a Web Server that acts as a specialized search engine for construction products. To formulate his query he has a small strip interface on the working area of his computer monitor, and within this strip he can choose different options to execute his search; in this case he knows which is the function of the material. (e.g. he needs something to be used as cladding for an external wall.).
He can write in free text "cladding" and he probably will get too many answers. So a window appears in his monitor, and gives him the option to refine his search by choosing other properties about the material for which he is searching. For instance, he can choose the materials configuration, if he prefers a small rigid sheet or a large rigid sheet. He can also decide if there is some particular attribute like insulating properties or special finishing that he wants. He then submits the request again. If the query gets no answer or gets products that do not satisfy the user, he can choose from a list of alternatives which the system produces from the submitted query. At the end of the search he will receive on his computer the information about the selected products in a multimedia technical data sheet. He can decide to display different layouts that show only the data he is interested in seeing, or can have a layout with all the selected products. For example, information about "metal small rigid sheet for cladding" can be displayed using text for general and technical description; pictures showing the texture pattern and colors; spreadsheet describing the range of product; 2D and 3D drawings or short video to illustrate the assembly of the product. All this information can be downloaded to the user's project database and the 2D and 3D models can be used directly in the CAD drawings.

4.GENERAL SYSTEM ARCHITECTURE OF THE CONSTRUCTION PRODUCT BROWSER

The search query selection

The search window, called in this system “Selettore”, is the part of the system that has the first relation to the user. In a communication between two individuals the understanding task is for the listener; in the case of an interaction between an individual and a computer, the task of understanding should be incorporated in the user interface, or interaction-space. Therefore the computer´s understanding ability resides in the possibilities programmed into the user interface, to allow user to express his questions.The “Selettore” is the part of the system that provides a switch from natural language to an artificial language suitable for computers.
The “Selettore” retrieval system prototype has access keys for searching, depending on which information about the product you already know.
Search options with “Selettore”:

- If you know the name or the producer of a building product you can use a free text field;
- If you know the name or the producer of a building product and would like to know about alternatives you can use a free text field;
- If you don’t know the name you can select the function and/or the shape and/or the material, according to EPIC classification plan;
- If you are searching a product with special attributes not included in previous options, you have an an extra-attributes field for it;

Supporting facilities also included in the “selettore” enable the:

- Selection of the product according with the date of the document published on the Web;
- Choice of user-language;
- Restriction of the search to specific geographical areas;

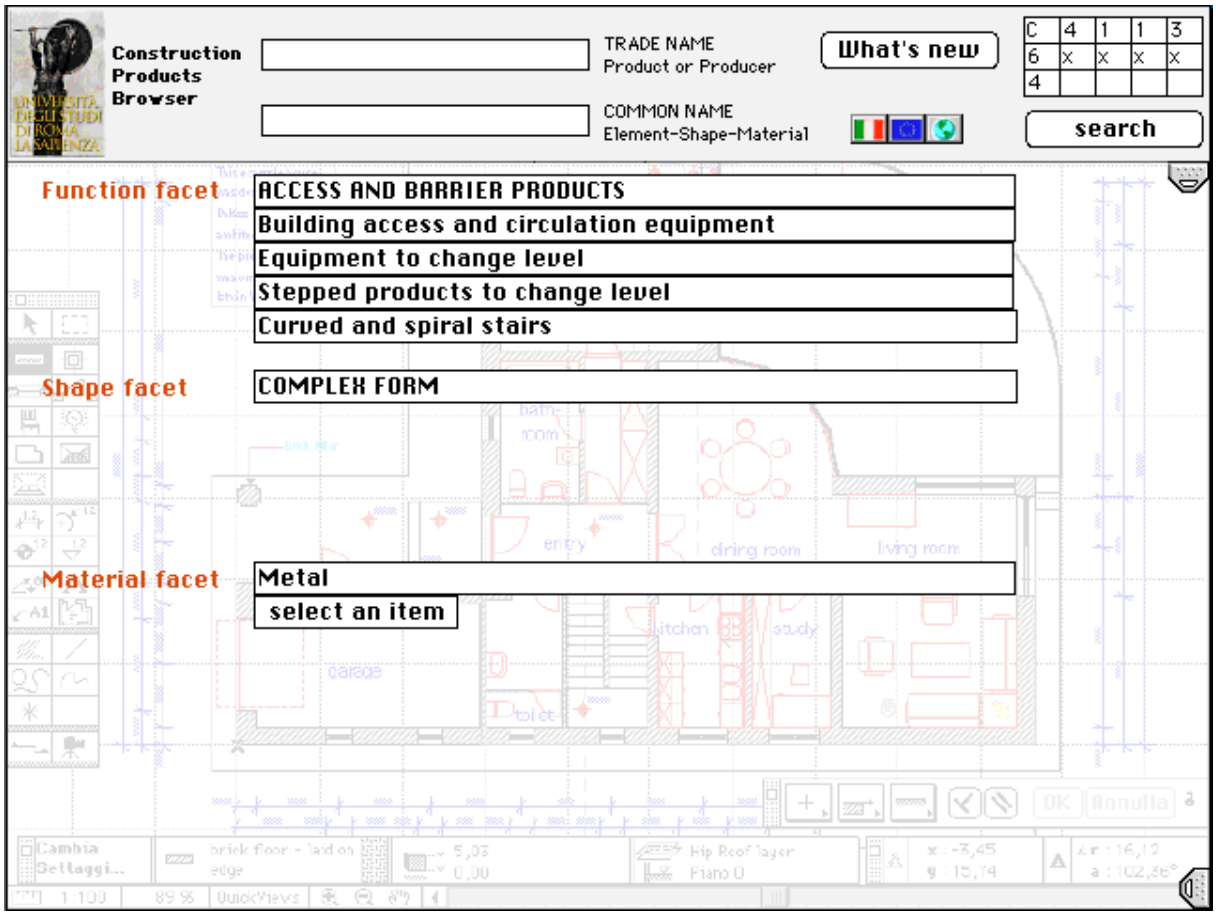

Figure 1: The Selettore user interface, on top the fields for natural language retrieval, below the hierarchical tree for querying using EPIC classification system

Those search options involve two different logical approaches in selecting a way to search:

- Natural language approach to text retrieval:

In natural language retrieval, a query is expressed in terms of words that are expected to be part of the stored document. We use, in our system, the natural language retrieval to search for a building product by commercial name and manufacturers name. We also use natural language retrieval for extra-attributes searching. For example, users could search for a product ´s thermal insulation properties via the word “insulation”. Natural language retrieval has advantages such as: high specificity, use of familiar terms and low input cost; disadvantages of this method are: unpredictable reply from the system and natural language´s reliance on user-generated search words. This restricts searches in a technical context because it restrict user´s ability to access lists of technically oriented choices which could suggest specific option to users.

- Controlled language retrieval;

In controlled language retrieval a query is based on formalized and organized vocabularies representing a comprehensive and coherent classification of concepts encountered in the subject matter. We used, as controlled language retrieval, EPIC´s (European Product Information Cooperation) construction-product grouping. EPIC product grouping is characterized by taking the function facet as the first classification criterion. Further subdivision is achieved by reference to shape and material. This multi-faceted approach lets the user make combinations of different properties and allows identification of a building product from different points of view. Different approaches to classification in the building context are discussed by Ekholm (Ekholm 1996). So that objects with a certain property may be retrieved separately from the series of different classifications (Ekholm 1996). Controlled language retrieval overcomes two natural language disadvantages: inadvertent access to non-pertinent information, and appropriate access to technical options. But it has disadvantages: high input costs; and that the user has to learn the artificial language of the controlled vocabulary. The combination of natural language retrieval with controlled language retrieval which we propose to provide with Construction-Product-Browser, assures the most flexible and technically correct option, and best retrieval results.

The display and selection of search results

Retrieval recall and precision are directly related to whether the keys and their combinations can appropriately express what the user is looking for. For example, a generic query under the heading “windows”, will generate too many responses to be useful, while a specialized query under “sliding iron windows with acoustic performance” will yields too few.
Depending on the expressed query, retrieval should yield too many or too few answers. In both cases a user would be unsatisfied with search results. In order to select the appropriate search terms, one often resorts to a “search intermediary” that offers a menu which allows for query refinement and the option to make an iterative modification of the query to improve retrieval performance. This option is called “relevance feedback.”(Koutamanis ,1995)
If there are too many answers a user can refine his search choosing from a list of subjects related to his query, or he can restrict the record number by selecting more specific keys to narrow his query. If there are too few or no answers, the Construction-Product-Browser system chooses a list of alternatives from the submitted question.
The alternatives principle in Construction-Product-Browser uses the EPIC classification system as a link generator. So, for instance, if a designer were to search for a product to be used for “cladding for external wall made in metal flat rigid sheet”, and the system had no or few answers, then the system would generate alternatives showing other products that are made for “cladding for roof made in metal flat rigid sheet”; or “cladding for external wall made in ceramics flat rigid sheet”; or “cladding for external wall made in metal flat rigid tiles” and so on, going from the narrower to the broader alternatives. Using Construction-Product-Browser, the designer can discover new products properly usable for different functions. The ability to generate alternative search paths in Construction-Product-Browser system is based on automatic generation of new classification codes originated with a simple algorithm by the original code of the query expressed using the EPIC classification system.

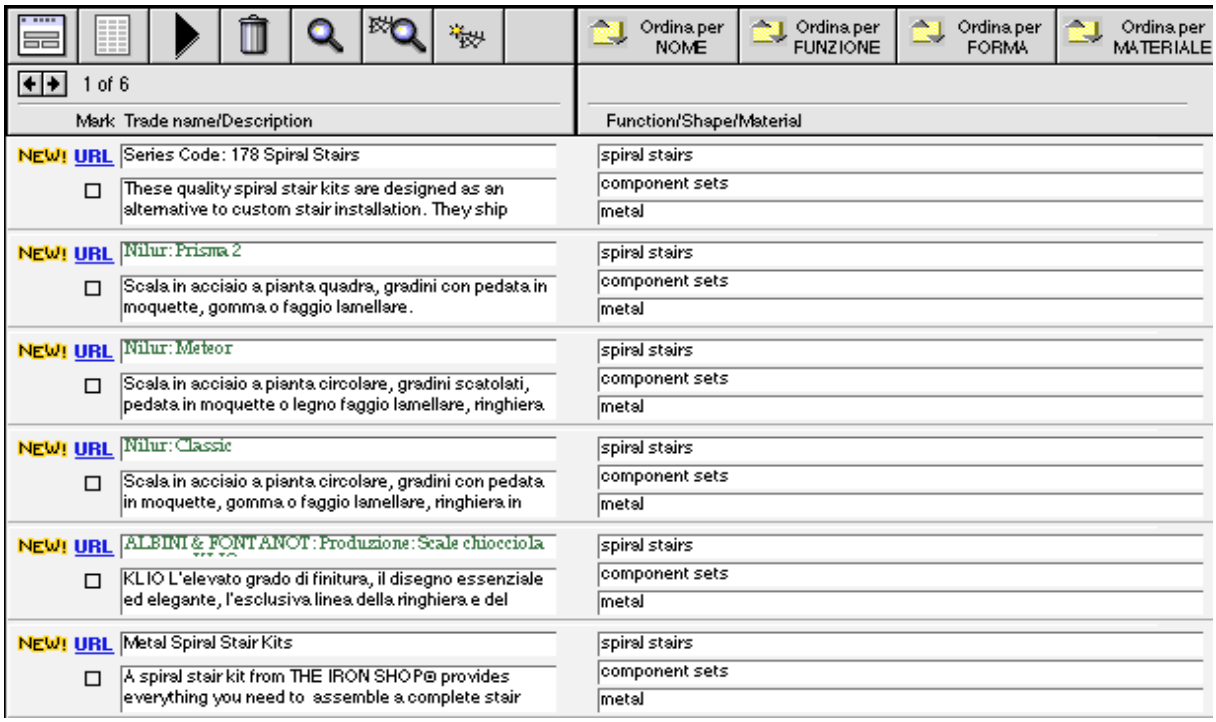

Figure 2: the results of a query in the relevance feedback window of the Selettore.

When the user selects the products in which he is interested, the selection goes through the Internet to a central database in the Construction Product Browser Web Server. Obviously this server doesn't contain all the information related to a specific product; instead, it should be the place where the query from the user can be readdressed to the right address (URL) on the Internet.

The handling product's data on the web

In order to allow the producers of building products to give information according to their own layouts without being forced into a rigid standardized layout, we propose an indexing system for the Construction Product Browser.
Our indexing system is based on the application of blind labels (tags) to the existing source code (html) which describes the information about a product that is already on the net. Those tags are invisible while browsing the producer's web site using the standard browsing programs (e.g. Netscape, Explorer) in the same way as tags currently used for indexing by search engines (e.g. AltaVista, Excite, etc.). We have based the tagging system of the Construction Product Browser on a subset of headings from the CIB Master Lists (CIB 1993) and UNI 9038 (UNI 1987) (to achieve more compatibility with the Italian marketplace) We suppose that, at least for a startup period, an agency should be responsible for finding the information and applying appropriate tags. After that period each manufacturer could apply the tags to his own web page.
Each piece of information, indexed by its own tag, will be handled by a specialized plug-in: a special kind of software that is automatically recognized and activated by the browsing program to put the information in the right place in our newly developed product data sheet, and to display it properly by generating a customized user interface.This mechanism avoids the construction of a centralized database, and replaces the need for it by accessing a series of indexed documents containing indexed information already on the Internet. Further, this indexing system allows a real time update of the information from manufacturers, avoiding the need to update the entire system containing only the addresses (URL) where such information may be found.

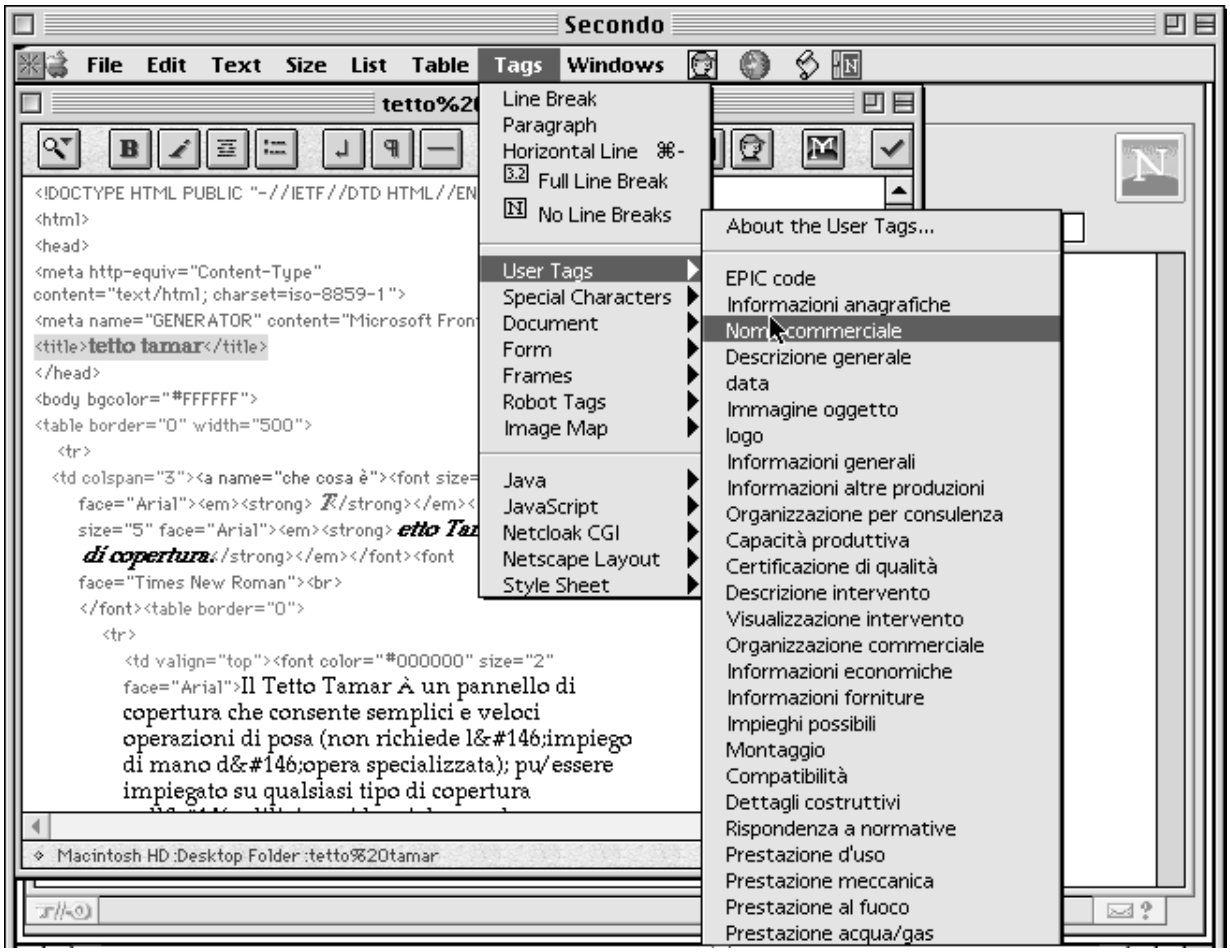

Figure 3: application of the tags to the existing source code (html) which describes the information about a product.

The display of the product information

Traditionally, paper-based product catalogues describes a range of product from a company and are designed to satisfy the different needs and wishes off all the different target users with only one catalogue (Follin 1994). A component such a door is of interest for the final user as it is for the architect in charge of the design of the building in which this door will be placed: the former user is more interested in how the component looks, its dimension and colors, while the latter needs more technical information to select the proper door and to include the component in a CAD drawing.

In order to satisfy both needs, paper-based product catalogues often contain an overload of information which is time consuming for both users. Obviously thedefinition of a general structuring model of the technical documentation is a demanding task, considering the huge number of the available products; the differences of their related information; and the different needs of the various actors of the building process in term of information. To answer to this we propose a multimedia data-sheet that works at the level of meta-contents instead of specific product-related information. Thus the same data sheet layout will be suitable to describe different classes of products (e.g. a door, a painting, an elevator). This will allow our data sheet to be at the same time independent of the information available on the products, and open to the addition of new types of information and navigational paths.

Our layout will:

- provide users a consistent organization of the information;
- avoid information overload to the user by displaying homogeneous group of data;
- enable users to make comparisons between different products;
- enable users to import all this information directly into their own documents.

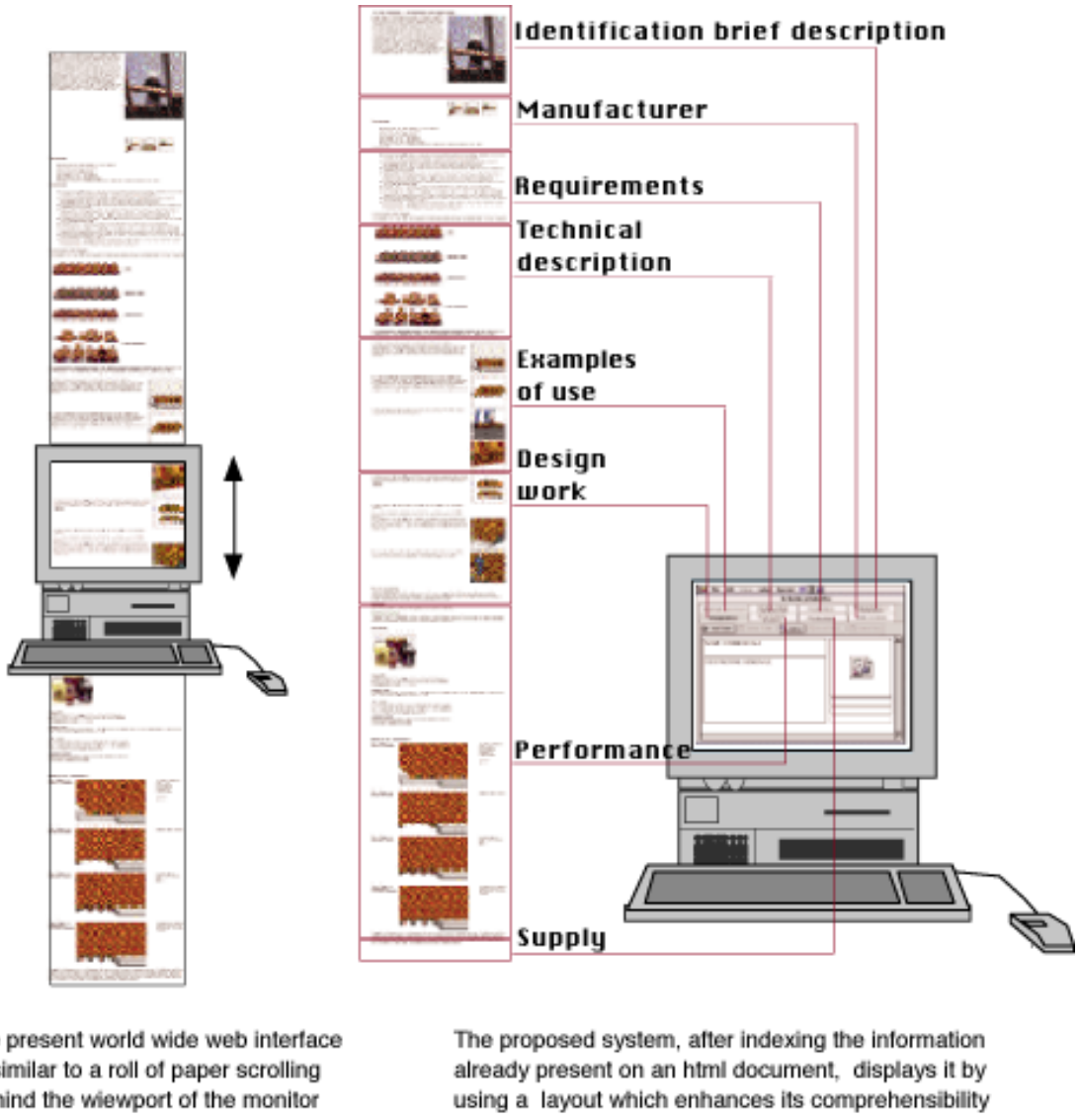

Figure 4: comparison between the standard www interface and the one developed for the multimedia product data sheet.

Our multimedia data-sheet is organized to ensure a clear and straightforward presentation of information. It relies on a tab-based navigation interface that gives users access to eight different stacked windows, in order to avoid the cluttering of the small monitor's space with an information overload (Anceschi 1997). Each window covers homogeneous headings from the CIB Master List and UNI 9038; thus ensuring completeness and consistency of the displayed information. A side-effect of this consistency is the ability of the product data-sheet to generate comparison tables between two or more products. Another side effect is that the efforts of a manufacturer to document in a complete way his products will be considered a bonus by the potential customer who will probably choose the better described product. The information contained in each window will be displayed using multimedia techniques: animation, QuickTime VR®, photorealistic renderings and text. The result will be an increase in comprehension, e.g. of the mechanical behavior of a product; of the assembly instructions; or the different versions, designs, or product combinations. Each tab of the multimedia data-sheet could be highlighted or not, depending on the presence or absence on information in the related window. In this way the user could avoid opening an empty window.

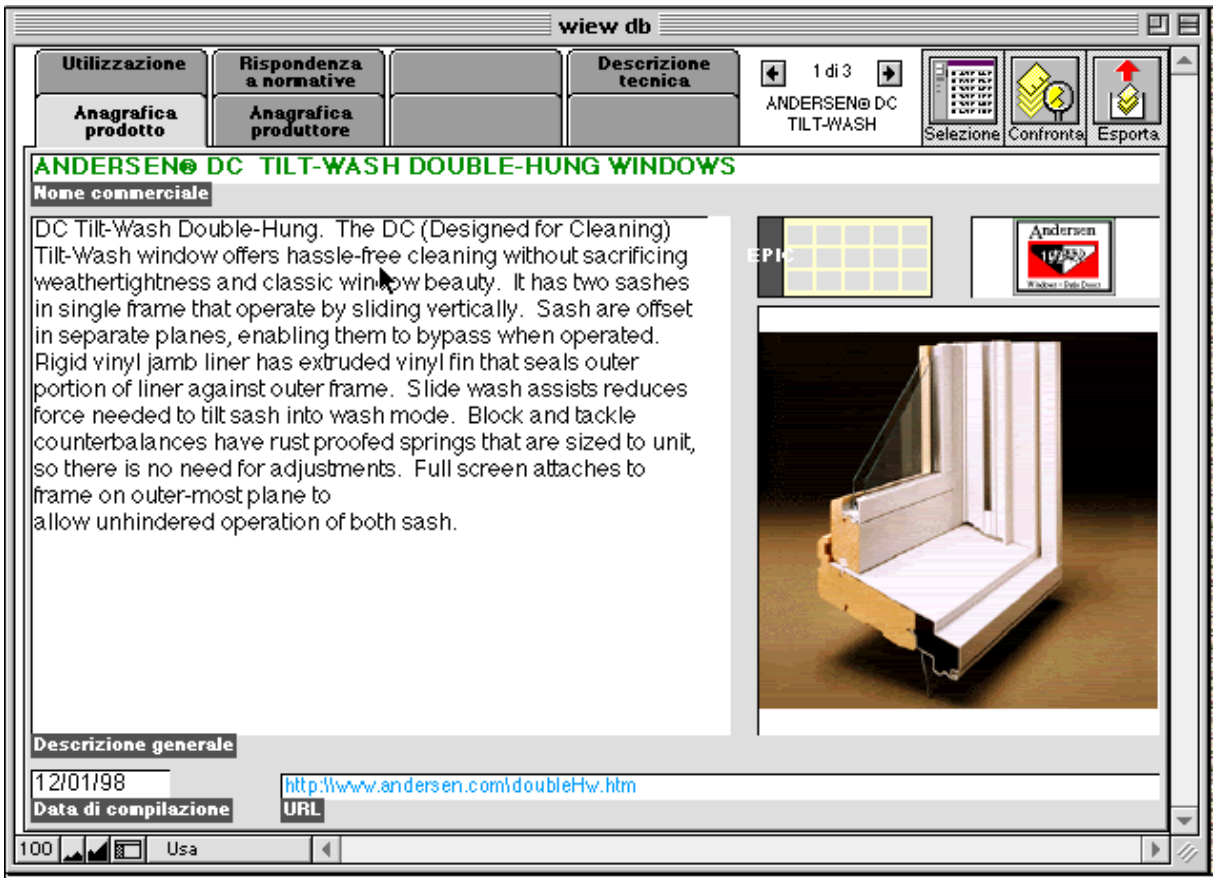

Figure 5: the multimedia product data sheet

The import and use of product information

One of our chief aims is that the product information displayed in our product browser will interface with other programs, such as CAD systems, permitting designers to collect and create databases pertinent to their specific projects (Martegani 1990) that will include not only the product geometry, but also other textual (e.g. prices, technical characteristics, specifications) (Mitchell 1977) or visual information (e.g.textures of building materials) in a centralized or distributed database .

Such personally created databases will store all the information contained in traditional building documents and make it possible to get all the drawings or other design related documents (Bjork, 1995). To achieve this goal, we are investigating the latest developments in the field of "building product data model" research in order to locate a data format which is capable of overcoming the serious limitations that today's formats (DXF, IGES) have in functionality and reliability. Unfortunately the activity carried out by the ISO STEP (ISO 1994) and IAI, International Alliance for Interoperability (IAI 1997), has so far not produced a standard adopted by commercial CAD vendors. This consideration leads us to employ in our prototype the DXF which, at present time, could be considered the de facto standard. A future development to be included in the upcoming version of the Construction Product Browser, is the support of a new technology developed by Autodesk® called Whip®! This technology, which is based on the high compressed file format DWF, has been developed to facilitate the sharing of vector-based files on the Internet.

Our prototype simulates the importation of some selected building products, in order to demonstrate the possibilities that such a data standard might offer. A prototype of the library-managing user interface will be also be simulated. This will be based on the so-called "Drag and drop" technique, where the user can drag the product (object, texture, etc.) that he has selected and drop it in an appropriate location in his document.

Conclusions

In this paper we have presented a model of an information system for building construction products, and discussed the main characteristics of such a system. In order to test our assumptions and display our goals we had developed a simulation of the system, by setting up a small net containing the data and by developing the interface design and the internal mechanism. This was done using existing commercial software like Macromedia Director and Claris File Maker. Part of the implementation of the system simulation has been developed at Lund University with the support and valuable ideas of Dr Anders Ekholm; we would like also to acknowledge Prof. Cristina Benedetti and Prof. Giuseppe Morabito of the department 'ITACA' - Faculty of Architecture - Rome University ‘La Sapienza’.

The introduction of indexing tags in our Construction Product Browser is a step in the direction of the development of HTML towards a more specialized description language for specialized contests. HTML is already overburdened with dozens of interesting but often incompatible inventions from different manufacturers, because it provides only one way of describing information. We think that new description languages are needed like XML (Extensible Markup Language), this will allow groups of people or organizations to create their own customized markup languages for exchanging information in their domain (music, chemistry, electronics, finance, linguistics, mathematics, history, engineering, *etc*). HTML is at the limit of its usefulness as a way of describing information, and while it will continue to play an important role for the content it currently represents, many new applications require a more robust and flexible infrastructure.

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